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Mycologia

ISSN: 0027-5514 (Print) 1557-2536 (Online) Journal homepage: https://www.tandfonline.com/loi/umyc20

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To cite this article: Ronald H. Petersen & Paul D. Olexia (1967) Type Studies in the Clavarioid Fungi. I. The Taxa Described by Charles Horton Peck, Mycologia, 59:5, 767-802, DOI: 10.1080/00275514.1967.12018468

To link to this article: https://doi.org/10.1080/00275514.1967.12018468

Published online: 12 Sep 2018.

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TYPE STUDIES IN THE CLAVARIOID FUNGI. I. THE TAXA DESCRIBED BY CHARLES HORTON PECK[1]

RONALD H. PETERSEN AND PAUL D. OLEXIA

Among the enormous number of fungi described as new by Peck [see lists of fungi described by Peck from 1867 to 1908 (Peck, **1909**) and from 1909 to 1915 (Gilbertson, **1962**)], a relatively small number are clavarioid fungi. Their significance in the taxonomy and fungous flora of North America cannot be overstated, however, and some of them seem to occupy important phylogenetic positions as well.

The floristic studies of Burt (**1922**), Coker (**1923**), Doty (**1944**) and Leathers (**1956**) were produced after Peck's death, but only the former two workers had occasion to closely examine the type specimens involved. Burt quoted the original descriptions for the most part, making appropriate comparisons where possible. Coker apparently closely examined the type specimens, for he faithfully compared spores, colors and gross morphology of Peck's specimens with those of specimens from other herbaria. Coker's criteria, however, consisted almost exclusively of these characteristics, and so lacked the microscopic hyphal detail of more modern descriptions.

Corner (**1950**) was the first worker to emphasize microscopic construction and hyphal configuration as well as the traditional characters in the taxonomy of the group, but, to our knowledge, he examined none of Peck's material prior to the publication of his monograph. Because of the lack of precise information on these specimens, they are herein described with additional detail.

A number of limitations should be noted in the descriptions. Especially when dealing with larger specimens, Peck often pressed or longitudinally sectioned fruiting bodies, and note is taken of this, because fruiting body shape is altered with either process. Color quotations are from Maerz and Paul (**1930**) and Ridgway (**1912**), the latter enclosed in quotes, the former cited as a number and letter code to the appropriate plate. Our color notations were made from *dried* material at the time

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[1] This project was supported in part by National Science Foundation grants GB369 and GB3353, and represents contribution no. 280 from the Department of Botany, University of Tennessee, Knoxville, Tenn.

Published online 12 Sep 2018

of examination, not from assumed fresh material. Notes on color of fresh material have been taken from Peck's original descriptions, and are meant only as an aid, no value judgments on their accuracy being made. Most important, the examinations reported here have been made with the aid of phase contrast microscopy, an optical aid found indespensible by the authors. *Clavaria lavendula, C. nebulosa* and *C. pallescens* were examined by the second author using a Leitz SM bright-field, phase contrast trinocular microscope magnifying up to 2,500 ×. All other examinations were made by the first author using a Wild M20 bright-field, phase contrast microscope with Treffenberg drawing tube, magnifying up to 2,500 ×. The advantage of such high magnification and phase contrast microscopy cannot be overstated. Hyphal wall structure and consistency, cellular inclusions, and spore wall and content characteristics can be observed without staining, and reveal features extremely difficult to observe under traditional conditions (i.e., water or phloxine mounts in bright field microscopy).

Mounts of spores were made also in cotton blue in lactic acid and in Melzer's reagent to ascertain cyanophily and amyloid reactions, these mounts being observed in bright field microscopy. Following the discussion and methods of Kotlaba and Pouzar (**1964**), the spore walls of most clavarioid fungi are non-cyanophilous, but the ornamentation of the spores of *Ramaria* species is found to accept the stain, making microscopic examination of this characteristic much easier. Cyanophily has been used by Donk (**1964**) as a unifying character of the family Gomphaceae.

CLAVARIA ACRIS Peck. 1901. N. Y. St. Mus. Rep. **54**: 155.

Basidiocarp: Fruiting bodies 3.5–6 × 2.5–5.0 cm, on very rotten wood, pressed. Stipe short, up to 1 cm broad, branched almost from the base, smooth, somewhat flattened or channelled, XI(F, G)5, 6 (between "cream-buff" and "chamois"). Branches ascending, tri- to dichotomous, somewhat flattened especially at the axils which are rounded to lunate. Color of major portion of fruiting bodies fairly uniform, XII(B, D)6 (about "clay color" or "tawny olive"), the tips VI(C, D)9, (between "Prussian red" and "Rood's brown"). Fresh color: branches reddish incarnate, whitish within; tips whitish or concolorous.

Hyphal structures: Stipe—Outer hyphal layers of narrow hyphae 3.2–4.0 μ diam, thick-walled, refractile, clamped, long-celled; tightly interwoven; inner tissue of thin-walled, hyaline, clamped, tightly interwoven hyphae. Branches—Contextual hyphae 2.8–7.0 μ diam, thick-walled skeletals; walls so thick that the cell lumen is obscured; refractile under phase contrast and pale yellowish under bright field. Subhymenium rudimentary; hyphae 2.5–3.2 μ diam, tortuous, thin-walled, perpendicular to the long axis of the branch; producing basidia in bouquets. Basidia 35–40 × 5–6.5 μ, subcylindrical to subclavate, generally homogeneous in content, clamped, appearing hyaline, 4-sterigmate; sterigmata slender, straight, slightly divergent, up to 7 μ long. Hymenium thickening.

Spores 5.6–7.7 × 3.5–4.3 μ, ovoid to subellipsoid, thick-walled, aguttulate, but with an obscure brownish smudge in the lumen under phase contrast; ornamented with low rounded warts in a subspiral arrangement. Spore ornamentation more distinct with cotton blue stain; dark ochre to brown in Melzer's reagent, with ornamentation appearing pruniform.

Observations: This belongs in a complex with *Ramaria stricta* and *R. crispula,* both of which have similar hyphal structure and general habit. However, the smaller spores and very refractile hyphae of the upper portions of the fruiting body clearly separate *C. acris* from these two. It may be synonymous with *R. apiculata,* but I have not yet examined type or authentic material of that species.

CLAVARIA ALBIDA Peck. 1888. N. Y. St. Mus. Rep. **41**: 79.

Basidiocarp: Fruiting bodies in silicaceous clay soil, 3–6.5 × 2.5–4 cm (not pressed). Stipe stout, 2–3 × 1.5–2 cm, rounded at the base, superficially longitudinally wrinkled, surface very hard on drying. Major branches few, short, rebranching polychotomously in 5–7 ranks. Smaller branches strongly collapsed and therefore longitudinally ridged or channeled; rebranched monopodially to polychotomously; branch tips irregular, minute, rounded or digitate, crested or subcrested, crowded, with pigmentation residing in the context. Branch axils very narrowly rounded, channeled below the furcation. Color of stem portion about XIII(H, I)9 ("Sayal brown"); branches about XII(D, E)6 ("tawny olive"); branch tips about VII(H, J)10 ("Chocolate"). Fresh color: uniformly whitish.

Hyphal structures: Stipe—Contextual hyphae 2.1–6.0 μ diam, uniformly thin-walled, clamped, tightly interwoven, hyaline; stipe covered with unthickened hymenial layer of refractile, thin-walled, clamped, basidioid hyphal tips 20–30 μ long, mostly sterile but with scattered fertile basidia and numerous spores. Branches—contextual hyphae 2.1–3.4 μ diam, hyaline, thin-walled, clamped, parallel with little interweaving; subhymenial hyphae 2.1–2.8 μ diam, subtortuous, thin-walled, clamped, tightly interwoven. Basidia 35–42 × 7–9.5 μ, clavate, clamped, 4-sterigmate; sterigmata slender, very slightly incurved, up to 7 μ long. Hymenium thickens through hyphal branching from or near the basidial clamp connection.

Spores 10.5–13.3(–14.7) × 3.5–4.3(–4.9) μ, cylindrical or slightly convex abaxially, smooth, slightly thick-walled, sometimes with a single brownish smudge under phase contrast; with an indistinct, subtruncate, lateral apiculus; somewhat ochraceous and obscurely roughened in Melzer's reagent, non-cyanophilous, with the walls appearing gritty or minutely granular in cotton blue, but not roughened.

Observations: Microscopically, this species can hardly be separated from *Ramaria obtusissima* (Pk.) Corner, but its smaller stature and finely dissected branch apices seem to distinguish it. The two species differ in their spore morphology in that *R. obtusissima* has spores 13.3–15.4 × 3.8–4.2 μ with mean spore dimensions of 13.61 × 4.04 (E = 3.36), while *C. albida* has spores as above, with mean spore dimensions of 11.47 × 4.46 (E = 2.57). The value of E is equal to the mean spore length divided by the mean spore width (see Corner, **1950**, for an explanation of this figure in regard to the clavarioid fungi). In my opinion, *C. albida* can be retained as a separate species, presumably placed within the present generic limits of *Ramaria.*

CLAVARIA AMETHYSTINOIDES Peck. 1907. Bull. Torrey Bot. Club **34**: 102.

≡ *Clavulina amethystinoides* (Pk.) Corner. 1950. Ann. Bot. Mem. 1: 298–299.

Basidiocarp: Fruiting bodies 1–3 cm high, on soil. Stipe slender, 1–1.5 × 0.1–0.3 cm, slightly flattened and laterally compressed toward the point of branching; minutely felty. Branches somewhat flattened, subpalmate, rugose, with the tips mostly acute, delicate, cristate and slightly flattened or narrowly rounded and then thicker and coarser. Color of hymenial portion about XIII(F, G)5 ("Buffy-olive"), stem portions about XIII(G, H)8 ("sayal brown"). Fresh color: very pale lilac, becoming drab gray in drying.

Hyphal structures: Stipe—Contextual hyphae 3.0–17 μ diam, thin-walled, clamped, inflated slightly, loosely interweaving, abundantly anastomosing and branching, hyaline. Stipe covered with mostly effete hymenial layer with only scattered fertile basidia. Branches—Contextual hyphae 3.0–12 μ diam, like those of stipe; producing basidia at first as side branches or divergent hyphal tips, but finally the hymenium thickening through hyphal branching from or near the basidial clamp connection. Basidia 28–38 × 4.2–5.2 μ, cylindrical, homogeneous in content (some becoming vacuolate toward maturity), clamped, hyaline, 2-sterigmate; sterigmata cornute. Post-partum septation occurs frequently but not invariably. After post-partum septation, the upper portion collapses, but the lower portion of the basidium remains turgid and appears somewhat refractile under phase contrast.

Spores 6.6–9.1 × 5.2–7.7 μ, subglobose to broadly pip-shaped, smooth, hyaline, very slightly thick-walled, vitreous opalescent under phase contrast, with a small but abrupt apiculus.

Observations: Macroscopically, this species is almost indistinguishable from *Clavulina vinaceo-cervina* Corner, but that species possesses no clamps, has longer basidia and oleaginous hyphae in the stem context. *C. amethystinoides* may also be related to *Clavulina cinerea* (Fr.) Schroeter, but the species limits in the *C. cristata-cinerea-rugosa* alliance have not yet been definitively drawn.

CLAVARIA BICOLOR Peck. 1902. N. Y. St. Mus. Rep. **54**: 954.
≡ *Clavaria peckii* Sacc. & Syd. 1905. Syll. Fung. **17**: 196.
≡ *Clavaria vestitipes* Peck. 1907. N. Y. St. Mus. Bull. **116**: 34. (≡ *C. vestipes* Burt, 1922; orthographic error).
≡ *Ramariopsis vestitipes* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 647.

Basidiocarp: Fruiting bodies 1–3 cm high, on leaf mold. Stipe 0.5–2 × 0.1–0.15 cm, minutely scurfy to scurfy-tomentose, expanded very slightly at the base. Branches few, about 1 mm thick throughout, dichotomous, longitudinally rugulose; apices acute, about 1 mm long, bidentate, often curling on drying. Branch axils narrowly rounded to acute. Color of stipe about XI(G, H)6 ("cinnamon buff"), upper portions about VI(L)10, 11 ("garnet brown" to "morocco red"). Fresh color: stem pale yellow: branches and tips orange.

Hyphal structures: Contextual hyphae 3–5 μ diam, thin-walled, strictly parallel, tightly packed, agglutinated, clamped, hyaline, long-celled. Subhymenial layer rudimentary; hyphae 1.5–2.5 μ diam, thin-walled, clamped, producing basidia first as side branches and then in a thickening hymenium. Basidia 25–34 μ long, clamped, thin-walled, homogeneous in content, agglutinated, mostly collapsed, 4-sterigmate; sterigmata slender, 4–5.5 μ long, slightly incurved.

Spores 3.5–4.2 μ diam, globose to subglobose, thin-walled, hyaline, aguttulate, with a small, indistinct apiculus; spore wall ornamented with numerous, closely set, short, sharp spines.

Observations: The species is a member of the genus *Ramariopsis* as presently understood. A number of the species of that genus have agglutinated contextual tissues and basidia. This species seems intermediate between *R. kunzei* (Fr.) Donk which is larger and white, and *R. crocea* (Fr.) Corner, which is slightly smaller and golden orange.

The species nomenclature, although devious, is quite clear. Peck's original name, *C. bicolor,* is a later homonym of *C. bicolor* Massee, and so it was changed to *C. peckii* Saccardo & Sydow. However, this too is a later homonym of another name combined by Saccardo, and so Peck renamed the fungus *C. vestitipes,* the valid species epithet. As such, it was transferred to *Ramariopsis* by Corner.

CLAVARIA BOTRYTOIDES Peck. 1905. N. Y. St. Mus. Bull. **94**: 49.
≡ *Ramaria botrytoides* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 562–563.

Basidiocarp: Fruiting bodies 5–7 × 3–6 cm, on clay soil, not pressed in drying, but longitudinally sectioned. Stipe developing deep beneath soil level, 2.5–4 cm long, producing branches at or very near the ground level; smooth, longitudinally rugulose or channelled, drying to a hard, dense consistency. Lowest branches vestigial or primordial, semiaborted, delicate, usually with pinkish tips. Major branches 2–4 mm thick, open, somewhat spreading, with primary internodes about 1 cm long. Branching pattern di- or trichotomous, open, with internode distances decreasing markedly and branch axils open-acute to narrowly acute and then decurrent by a line. Branch tips finely dissected, minutely digitate, usually double dichotomous, with little terracing. Color of major portion of fruiting bodies about XI(G, H)4 ("cream buff"), with the branch tips suffused pinkish, about V(I, J)3 ("Eugenia rose"). Fresh color: stem and branches whitish; tips red or pink when young, concolorous in age.

Hyphal structures: Stipe—Contextual hyphae of 3 types; 1) very rare thin-walled, oleaginous, uninflated hyphae, 2.4–5 μ diam; 2) somewhat tortuous, hyaline, thin-walled, sometimes clamped hyphae, homogeneous in content, 2.1–2.5 μ diam, and 3) rather straight, thin-walled, hyaline, simple-septate hyphae 4.0–6.5 μ diam, with numerous small darkish smudges visible under phase contrast, and with pronounced, somewhat thick-walled, minutely punctate swellings up to 15 μ diam, distal to septa. All contextual hyphae subparallel with some interweaving, but arranged in no regular tissues. Stipe covered with effete hymenial cells, the more turgid of which are refractile, but mostly sterile. Basidioles simple-septate and hymenial layer covered with numerous spores. Branches—contextual hyphae 4.0–6.5 μ diam, thin-walled, hyaline, simple-septate, interweaving, swollen to about 10 μ distal to septa, Basidia 42–52 μ long, clavate, simple-septate, homogeneous in content, 4-sterigmate; sterigmata slender, slightly incurved, up to 6 μ long. Hymenium thickening through hyphal branching from or in juxtaposition to the basidial septum.

Spores 8.4–10.1 × 3.6–4.6 μ, short-cylindrical to subovate, slightly thick-walled, pale yellow in mass, with obscure dark vacuolar structures under phase contrast, and with an indistinct lateral apiculus. Wall ornamented with longitudinal rows of low obscure warts. Spore ornamentation cyanophilous; spores pale brownish in melzer's reagent.

Observations: This species is surely synonymous with *C. conjuncta* Pk. (see below), and is related to a group of species in *Ramaria* bearing thin- to thick-walled contextual hyphae and shagreened spores. The longitudinal orientation of the spore ornamentation may indicate a more primitive position within the complex, but the rare oleaginous hyphae are typically found in the group.

CLAVARIA CIRCINANS Peck. 1886. N. Y. St. Mus. Rep. **39**: 43.

Basidiocarp: Fruiting bodies 3–5 × 1.5–2 cm, on moss and hemlock litter, pressed, arising from a small, cottony mass of rhizomorphic strands. Stipe 3–7 mm thick, minutely felty toward the base, smooth but not glabrous above, generally round in cross-section, but channelled or ridged. Primary branches few, 2–4 mm thick, ascending, rebranching into slightly flattened, ascending, channelled branchlets. Branch axils rounded-acute to acute; apices di- to trichotomous, acute, minute, about 0.5 mm thick. Flesh of stem portion drying quite soft and chalky. Color of stem and primary branches about XI(D, E)4,6 ("warm buff"), or about X(E, F)3,4 ("cream buff"); branch apices darker, about XIII(C, D)8,11 ("mikado brown"). Fresh color: uniformly pallid or almost whitish.

Hyphal structures: Stipe—Contextual hyphae 5–12 μ diam, almost all thin-walled, conspicuously clamped, loosely interweaving, almost uninflated, slightly swollen adjacent to clamps. Stipe covered with fertile thickened hymenium over 100 μ thick; basidia typical. Branches—Contextual hyphae 5–8 μ diam, thin-walled, interweaving to loosely parallel; subhymenial hyphae 3.5–5 μ diam, tightly packed, subtortuous, clamped. Basidia 40–45 × 6–8 μ, clavate, with a subtortuous attenuate base, clamped, mostly homogeneous in content, 4-sterigmate; sterigmata slender, slightly incurved, up to 9 μ long.

Spores 8.4–9.8 × 3.2–4.2 μ, ellipsoid to short cylindrical, very slightly thick-walled, very pale yellowish under bright field; with an indistinct, conical, lateral apiculus. Wall not cyanophilous, dark ochre in Melzer's reagent, ornamented with spiralled rows of small, distinct, short, rounded warts, which are cyanophilous.

Observations: This may be related to *Ramaria suecica* with its soft, chalky dried flesh and velvety to felted base. I have been forced to place it alone in a separate group within *Ramaria,* because of the combination of thin-walled contextual hyphae, clamp connections, and spirally warted spores.

CLAVARIA CLAVATA Peck. 1873. Buffalo Nat. Sci. Soc. Bull. **1**: 62.

Basidiocarp: Fruiting bodies 0.6–1.3 × 0.1–0.2 cm, associated with algae on clay soil, clavate to subclavate, with the apex white when dried; simple, scattered or gregarious but not caespitose. Color of fruiting bodies uniformly about V(F, G)11 ("brick red" or "Hay's russet"). Fresh color: yellow when fresh, orange-colored when dry.

Hyphal structures: Contextual hyphae 2.0–3.2(–7) μ diam, thin-walled, clamped throughout, parallel at the stipe base to loosely interweaving toward the apex. Subhymenial hyphae identical to contextuals. Basidia 18–23 μ long, broadly cylindrical, thin-walled, arising as subglobose to broadly pyriform hyphal tips, collapsing after spore discharge, clamped at the base.

Spores variable, 5–9.5 × 2.1–2.4 μ, thin-walled, cylindrical to suballantoid, smooth, hyaline, with no apparent apiculus.

Observations: In this complex, spore size and number of sterigmata are primary taxonomic characters, but the spores of this specimen are probably immature, and no accurate measurement of sterigmata number could be made. Coker (**1923**) and Burt (**1922**) indicate that it is synonymous with *C. vernalis* Schw., and I have no dispute with this, because the basidiocarp characters are identical as are the hyphal structures of the fruiting body context. *C. vernalis* has been transferred to *Multiclavula* by Petersen (**1966b**).

CLAVARIA CONJUNCTA Peck. 1906. N. Y. St. Mus. Bull. **105**: 42–43.
≡ *Ramaria conjuncta* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 566–567.

Basidiocarp: Fruiting bodies 4–8 × 2–4 cm, slightly pressed. Stipe slender, broken just below basal branches in every case, up to 1.2 cm thick, extremely hard and longitudinally wrinkled or channelled after drying. Branches in 5–7 ranks, deeply channelled, generally ascending, slightly and variously curled; major branches 3–7 mm thick. Internodes longish below, then shortening to give a generally open appearance.

Branch axils open-acute to acute; apices crowded, very short, obscurely double dichotomous, minutely rounded. Color of major portion of fruiting body about XI(G, H)5 to XI(I, J)6 ("chamois" to "Honey yellow"), with the branch tips suffused with pinkish tints, about III(D, E)10 ("Japan rose" to "Onion skin pink"). Fresh color: branches whitish or pale buff; apices pale pink, sometimes with a yellowish tinge.

Hyphal structures: Stipe—Contextual hyphae of 2 types: 1) 4–15 μ diam, uniformly thin-walled, variously inflated, obscurely parallel, almost pseudoparenchymatous, rarely with a clamp connection, and 2) occasional thin-walled, oleaginous, flexuous, tortuous hyphae 4–12 μ diam, grossly like "puff" chromosomes in appearance, refractile under phase contrast, pale yellowish under bright field, not rosy in sulfovanillin. Stipe not covered with hymenium. Branches—Contextual hyphae 2.1–7 μ diam, thin-walled, almost strictly parallel, simple-septate, often with numerous small darkish smudges under phase contrast, appearing hyaline. Subhymenial hyphae 2.1–3 μ diam, tortuous, simple-septate, producing basidia in bouquets. Basidia 46–54 μ long, clavate, simple-septate, generally homogeneous in content, appearing hyaline; 4-sterigmate. Hymenium thickening through hyphal branching from or near the basidial clamp. Fertile basidia do not protrude from the hymenial surface.

Spores 8.4–11.2 × 3.5–4.3 μ, subcylindrical to subellipsoid, slightly thick-walled, obscurely uni- to multiguttulate (guttulae dark under phase contrast, pale yellow under bright-field), ornamented with numerous cyanophilous, low, rounded warts set in obscurely longitudinal rows.

Observations: There can be little doubt that this is the same as *C. botrytoides* Pk. (see above). The oleaginous contextual hyphae, the rare clamp connections, and the shagreened spores, as well as the pinkish branch tips and open, slender stem and major branches, set it apart from other species of *Ramaria*.

CLAVARIA CORYNOIDES Peck. 1879. N. Y. St. Mus. Rep. **31**: 39.

Basidiocarp: Fruiting bodies 5–8 × 0.4–0.9 mm, associated with filamentous algae, and nakedly inserted in clay soil; clavate, occasionally 1- to 2-lobate. Branch axils, when present, sharply acute, but with a somewhat open angle. Color of lower portion pale watery orange-ochre, with the upper portion slightly lighter. Fresh color: club yellowish or cream colored; stem white.

Hyphal structures: Lower portion—Contextual hyphae 3–7 μ diam, thin-walled, parallel, tightly packed, hyaline, clamped throughout, usually slightly inflated adjacent to the clamp, abundantly branching and anastomosing, slightly agglutinated. Upper portion—Contextual hyphae 3–7 μ diam, loosely interweaving, thin-walled, clamped throughout, hyaline. Subhymenial hyphae closely packed, somewhat pseudoparenchymatous, interweaving, narrow, clamped, producing basidia first as side branches, later in cymose bouquets. Basidia 15–20 μ long, arising as subglobose hyphal tips, elongating to short-clavate or broadly cylindrical; clamped, hyaline, homogeneous in content, 4- to 5- to 6-sterigmate; sterigmata short, slender and fragile.

Spores 7.1–8.5 × 2.3–2.8 μ, cylindrical to bacilliform, homogeneous in content, thin-walled, hyaline, with a small, indistinct, lateral apiculus.

Observations: This has been transferred to *Multiclavula* by Petersen (**1966b**) who stated that it was conspecific with *Clavulinopsis septentrionalis* Corner. It differs little from *M. coronilla* (Martin) Pet. except in slightly darker colors and slightly larger spores.

CLAVARIA CRASSIPES Peck. 1903. N. Y. St. Mus. Bull. **67**: 27.

Basidiocarp: Fruiting bodies 5–7 × 5–7 cm, longitudinally sectioned. Stem portion stout, 1.5–3 cm thick, rounded at the base, longitudinally ridged and very hard when dry, with evidence of dark staining on the surface and cut flesh indicating discoloration or staining where handled or bruised. Major branches few, short, up to 1 cm long, up to 1 cm thick, branching polychotomously into several smaller branches, which rebranch monopodially in 3–5 ranks. Branches generally ascending; axils narrowly rounded. Apices incurved when dry, minutely cusped to minutely multicusped. Hymenium ochraceous; subhymenium and outer context deeply pigmented. Color of stem portion about VI(K, L)10 ("Madder brown") in the lighter areas to about VII(L)11 ("Hessian brown") in the darker. The major portion of the fruiting bodies is about XII(K, L)6 ("yellow ochre" to "old gold"), with a very slight flush of pink on the branch apices. Application of KOH causes a deep red color on the stem, and tissue placed in KOH causes the solution to become orangey brown. Fresh color: stem and branches white or whitish; tips whitish or slightly yellowish.

Hyphal structures: Stipe—Contextual hyphae 2.6–7.5 μ diam, tightly packed; slightly thick-walled to thick-walled, rather straight, with occasional clamp connections; branching abundantly. Rare thin-walled, oleaginous hyphae also present, interweaving with normal contextual hyphae. Branches—Contextual hyphae 2.1–3.5 μ diam, thin-walled, occasionally clamped, strictly parallel, tightly packed, subtortuous. Basidia 55–80 μ long, elongate-clavate, long-attenuate at the base, sometimes clamped at the base, often subgeniculate, especially in immature hymenium, protruding up to 35 μ from the hymenial surface when mature. Basidioles also protruding up to 35 μ from the hymenial surface. Hymenium thickening through hyphal branching from or near the basal basidial clamp.

Spores 14.7–18.9 × 3.8–4.6 μ, cylindrical, slightly thick-walled, pale ochre under the microscope, with an indistinct, lateral apiculus; wall non-cyanophilous, non-amyloid; wall ornamented with numerous, conspicuous, slightly spiralled cyanophilous longitudinal ridges or striations.

Observations: This is almost certainly synonymous with *C. holorubella* Atkinson. Their spore morphology, interweaving oleaginous, contextual hyphae and staining flesh are very similar. Another species is represented in the type collection which has spores as figured by Coker (1923). It may represent *Ramaria fumigata* (Pk.) Corner or *R. fennica* (Karst.) Corner.

CLAVARIA DENSA Peck. 1888. N. Y. St. Mus. Rep. **41**: 79

Basidiocarp: Fruiting bodies 5–10 × 2–5.5 cm, pressed on cards. Stipes rounded at base, subfasciculate or connate, of smaller stems each about 5 mm thick, white at very base, minutely felty. Larger fruiting body with stout stem portion 1.5 cm thick, branching about 2.5 cm from the base. Major branches few, often anastomosing, generally ascending, soon rebranching to form a compact, dense mass of small branches. Branching pattern monopodial to subdichotomous with few trichotomies and narrowly rounded axils. Mature branch apices irregular and minutely multicusped. Flesh of stipe soft and punky. Color of stipe about VI(B, C)11 ("auburn") in the darker areas, about XI(F, H)6 ("warm buff") in the lighter areas and the major portions of the fruiting body. Apices slightly pinkish, about XII(A)7 ("Cinnamon"). Tissue in KOH turns the solution darkish ochre color. Fresh color: uniformly whitish or creamy yellow.

Hyphal structures: Stipe—Surface covered here and there with spores, giving it a darker ochre appearance than its own hyphal structure. Contextual hyphae 2.1–6.5 μ diam, thin-walled to occasionally slightly thick-walled, simple-septate, subparallel, often swollen adjacent to septa up to 17 μ thick, hyaline, tightly packed and somewhat crushed in the outer portion, more loosely arranged within. Branches—Contextual hyphae 2.1–4.5 μ diam, thin-walled, simple-septate, tightly packed, in a distinct layer. Basidia 38–50 μ long, clavate, simple-septate, often geniculate or with a definite protuberance toward the base; 2- to 4-sterigmate; sterigmata straight, somewhat slender, up to 6 μ long.

Spores 8.4–11.9 × 4.5–6.0 μ, ovate to short-cylindrical, slightly thick-walled, usually with a darkish vacuolar structure within under phase contrast, ochraceous in mass under the microscope, with a small but distinct lateral apiculus; wall non-cyanophilous, non-amyloid, ornamented with subpruniform longitudinal cyanophilous ridges and channels forming striae slightly spiralled in arrangement.

Observations: This seems to be a valid species, close to *Ramaria secunda* (Berk.) Corner, which bears the same sort of spores and lacks clamp connections. The subspiral configuration of the ridges on the spore wall may relate it to the *Ramaria botrytis* group.

CLAVARIA DENSISSIMA Peck. 1903. Bull. Torrey Bot. Club **30**: 98–99.

Basidiocarp: Single fruiting body 11 × 6 cm, not pressed, probably on rich leaf litter in mixed forest, growing around prostrate branches and twigs. Stipe fasciculate, of slender substipes, each about 3–5 mm thick, but all enclosed in a copious felty mycelium covering and filling in between the separate substipes to form what appears as a single stout stem 3.5 cm thick and about 6 cm long. Major branches 2.5–4 mm thick, expanding slightly adjacent to branch axils; all strictly ascending, anastomosing abundantly into an intricate network of coalescing branches; slightly flattened. Axils narrowly rounded, often tear-drop-shaped with the upper anastomosis of branches. Branch tips minute, flattened, crested, shallowly cusped, the axil decurrent by a line. The flesh of the stipe and lower branches soft and chalky when dry. Mounts of tissue in 2% KOH turns that solution yellow ochre. Color of major surface of the fruiting body about XII(F, G)5,6 ("Tawny olive"), branch tips slightly darker, about XIV(B, C)6 ("light brownish olive") with the very apices abruptly whitish, and the pale felty stem portion about X(B, C)2 ("cartridge buff"). Fresh color: uniformly whitish to pale ochraceous.

Hyphal structures: Stipe—Contextual hyphae 2.8–8.5 μ diam, slightly thick-walled to very thick-walled, many refractile because the walls obscure the lumen of the cells, clamped throughout, the walls often more than 2 μ thick; generally parallel although somewhat loosely arranged; covered with effete hymenium. Branches—Contextual hyphae 2.6–3.2 μ diam thick, slightly thick-walled to thick-walled, parallel in the medullary tissue, tightly subparallel in the cortical tissue, hyaline, clamped throughout, long-celled. Basidia 32–40 μ long, clavate, basally clamped, homogeneous in content, 4-sterigmate; sterigmata up to 7 μ long, straight, not divergent.

Spores 7.0–9.1(–9.8) × 3.2–4.2(–4.6) μ, short cylindrical to ellipsoid, slightly thick-walled, aguttulate, darkish under phase contrast, very pale greenish-yellow under bright field, yellowish to yellow ochre in mass under the microscope; wall ornamented with numerous, cyanophilous, scattered, very short spines, with no apparent pattern.

Observations: Coker (**1923**) was unable to observe the type specimen of this species and conjectured that it was synonymous with *C. stricta.* That species has thick-walled contextual hyphae, and the fruiting body characteristically has long internodes and lack of branch anastomoses, as well as spores which are roughened by low channels or ridges. Microscopically, *C. densissima* is extremely close to *C. tsugina* (see below), from which it differs only in the spacing and size of the spines on the spores. Macroscopically, however, the two species differ considerably, *C. tsugina* being smaller, with a definite stipe, lack of branch anastomoses, mahogany coloration with evident greenish tints, and a generally open, obpyramidal shape. The two species belong together in a separate alliance within *Ramaria,* as that genus is presently understood.

CLAVARIA DIVARICATA Peck. 1887. N. Y. St. Mus. Bull. **2**: 11.
≡*Ramaria divaricata* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 574.

Basidiocarp: Fruiting bodies on soil, 2.5–6 × 2–5 cm broad, not pressed. Stipe short, somewhat stout, 1.5–2 cm thick, narrowing to a rather sharp point at the base, which is white where covered with soil. Major branches few, thickish, divaricate, rebranching into smaller divaricate branches. Axils open-acute, somewhat decurrent by a line; branch apices minute, cusped to rounded, divergent to recurved, short. Color of entire fruiting bodies about XI(G, H)6,7 ("cinnamon buff") to XIII(B, C)7 ("Snuff brown"). Stem flesh quite soft when dry. Fresh color: stem whitish; branches pale ochraceous.

Hyphal structures: Stipe—Outer tissue of slightly thick-walled hyphae, tortuous, tightly interwoven. Hyphae of inner tissue 2.4–15 μ diam, almost uniformly thin-walled, subparallel, rather straight, slightly inflated, simple-septate, hyaline, with numerous small darkish smudges within under phase contrast; with occasional bulbous, broadly clavate, minutely punctate swellings adjacent to septa, these usually thicker-walled than the parent hypha. Branches—Contextual hyphae 2.4–3.5 μ diam, thin-walled, simple-septate, parallel, hyaline. Basidia 50–75 × 5.5–6.5 μ, clavate, often "worm"-like, often geniculate or with a lateral protuberance, hyaline, simple-septate, with numerous small darkish smudges within under phase contrast. Hymenium thickening through hyphal branching just below the basidial septum.

Spores 10.5–13.3 × 4.2–4.9 μ, short-cylindrical to subellipsoid, slightly thick-walled, with many small darkish vacuolar structures under phase contrast, with an indistinct lateral apiculus; wall ornamented with scattered cyanophilous patches, broad warts or small plates in a random configuration; wall non-cyanophilous, non-amyloid.

Observations: This species belongs to a little understood alliance within the genus *Ramaria* which includes *C. xanthosperma, C. botrytoides,* and *C. densa.* The bulbous swellings on the contextual hyphae near the septa are also characteristic of *C. botrytoides.*

CLAVARIA EXIGUA Peck. 1901. N. Y. St. Mus. Rep. **54**: 155.

Basidiocarp: Single fruiting body, about 1 cm high, on wood or woody litter, delicate, with branch apices broken off. Stipe slender, 3–4 × about 0.6 mm, expanded slightly toward the branching point. Branches fairly numerous, trichotomous at first then strictly dichotomous; open. Branch apices minute, rounded-acute; axils rounded to narrowly-rounded. Fruiting body arising from small mycelial felt or pad, probably white when fresh; lower stipe covered up to 1 mm with minute subrugulose mycelial felt. Upper stipe and lower branches appear cartilaginous and brittle under the dissecting microscope. Color of upper stipe and branches pale tan, branch apices cream to very pale tan. Fresh color: stipe white; branches delicate lavender color.

Hyphal structures: Contextual hyphae uninflated, somewhat agglutinated, hyaline, conspicuously clamped throughout, parallel, tightly packed toward the branch apices and branches. Basidia 14–20 × 3.5 μ, thin-walled, hyaline, yellowish in mass, at first arising as side branches of contextual hyphae, then in a slightly thickening hymenium by hyphal branching from or near the basidial clamp, 4-sterigmate; sterigmata 4–6 μ long, straight, slender, easily collapsed.

Spores 2.1–3.0 μ diam, globose to subglobose, hyaline, thin-walled, uni- to aguttulate (in age?), with a short, prominent, lateral apiculus; wall finely and sparsely echinulate with short, scattered spines.

Observations: Peck's description stated the fresh color as "delicate lavender color" but the base as whitish. Coker placed *C. exigua* in synonymy with *C. pulchella* Boud. which has approximately the same coloration in fresh condition. I think *C. exigua* should be kept separate from *C. pulchella* until type material of that species is also examined. Both species are related to *C. kunzei,* and are therefore in *Ramariopsis.*

CLAVARIA FELLEA Peck. 1898. N. Y. St. Mus. Rep. **51**: 292.

Basidiocarp: Fruiting bodies 1–2.5 cm high, on soil. Stipe 0.5–1 cm long, smooth, inserted nakedly into substrate. Branches slender, 1–2 mm thick; rebranching dichotomously throughout; apices rounded to narrowly rounded; branch axils lunate. Pigmentation about dull light ochraceous all over, resident in the hymenium and subhymenium. Fresh color: golden yellow, sometimes brownish at the apex, flesh white.

Hyphal structures: Contextual hyphae 5–7 μ diam, generally parallel, slightly inflated, thin-walled, clamped throughout; interwoven with narrow (1.5–2.5 μ thick), thin-walled, hyaline, clamped, somewhat tortuous, frequently branched hyphae. Subhymenial hyphae 1–2.5 μ diam, thin-walled, clamped, tortuous, pigmented slightly in the yellow shades, producing basidia in clusters. Basidia 35–70 × 7–10 μ, clavate to elongate-clavate, clamped, yellowish, 4-sterigmate; sterigmata 6–10 μ long, stout, slightly incurved.

Spores 5.7–7.2 × 5.2–7.5 μ, globose to subglobose or slightly adaxially flattened, thin- to very slightly thick-walled, hyaline, uni- to aguttulate (in age?), smooth, with a prominent conical lateral apiculus.

Observations: Most authors agree that this is simply a form of *Clavaria corniculata,* which is accepted by Corner (**1950**) and Petersen (**1966c**) as *Clavulinopsis corniculata.*

CLAVARIA FUMIGATA Peck. 1879. N. Y. St. Mus. Rep. **31**: 38.
≡*Ramaria fumigata* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 591–593.

Basidiocarp: Fruiting bodies on soil, 7–8 × 3–3.5 cm, not pressed. Stipe smooth, stout, slightly attenuated to an acute base; longitudinally channelled or rugulose, pithy or punky on drying; flesh pale buff color. Branches stout; internodes of medium length (1–0.2 cm long progressively), primary branches 6–7 mm thick. Branching in 8–10 ranks, generally ascending. Branch axils narrowly rounded; apices short-furcate to bidentate. Color of branches about XIII(C, D)6 ("buffy brown") near the stipe, XII(I, J)3,4 ("Ecru-olive") upwards, especially the axils where spores have gathered. Stipe about XI(C, D)5,6 ("pinkish buff" to "cinnamon buff"). Fresh color: stem whitish; branches smoky-ochraceous, sometimes tinged with lilac.

Hyphal structures: Stipe—Contextual hyphae of two types: 1). 1.4–2.8 μ diam, thick-walled, clamped, long-celled, hyaline, uninflated (refractile under phase contrast), and 2). 6–9 μ diam, thin-walled, hyaline, uninflated, clamped, straight. Branches—Contextual hyphae 3–8 μ diam, thin-walled, uninflated, clamped, hyaline. Subhymenial hyphae few, thin-walled, hyaline, tortuous, tightly packed. Basidia 40–47 × 4–6 μ, hyaline, thin-walled, clavate, clamped; 4-sterigmate; sterigmata up to 7 μ long, slender, slightly divergent and incurved at the apex.

Spores 7.8–11.4 × 3.5–5.0 μ, ellipsoid to subcylindrical, slightly thick-walled, aguttulate to obscursely uniguttulate (rarely), pale ochraceous under phase contrast, pale watery yellow under bright field; with a slightly curved, indistinct, truncate, thin-walled lateral apiculus. Walls are ornamented by cyanophilous low but distinct rounded warts irregularly shaped and placed.

Observations: There has been a difference of opinion as to whether *C. fumigata* was distinct from *C. fennica* Karsten. Karsten's description of *C. fennica,* and Bresadola's figure (**1932**) show that species to be mustard green when mature, and Peck's description of *C. fumigata* states "smoky ochraceous." Several collectors, of whom I (R. H. P.) have been one, have recognized both species, however, saying that *C. fumigata* is cinnamon brown when mature. I now consider the 2 species to be synonymous, with the taxon producing cinnamon brown fruiting bodies a form of *C. fennica.* Both taxa have immature fruiting bodies of a beautiful delicate lavender color, changing color in the upper portions in maturity, and not showing the lavender shades on drying.

CLAVARIA GRACILLIMA Peck. 1876. N. Y. St. Mus. Rep. **28**: 53.

Basidiocarp: Fruiting bodies 2.5–3.5 cm × about 1 mm, simple clubs on soil, nakedly inserted. Stem portion about 0.4–0.7 mm thick, distinguished from the hymenium slightly by lighter color, but not by texture; apices rounded-acute. Color of fruiting bodies now very delicate fleshy ochre or pale apricot. Fresh color: club pale yellow; stem bright shining yellow.

Hyphal structures: Contextual hyphae 5–9 μ diam, generally parallel but not altogether straight, slightly inflated, thin-walled, clamped throughout; interwoven with narrow (1.5–2.5 μ thick), thin-walled, hyaline, tortuous, clamped hyphae. Subhymenial hyphae 1.5–2.5 μ diam, thin-walled, clamped, gnarled, tightly packed, producing basidia as side branches at first, then in monopodial bouquets. Basidia 43–60 × 5–7.5 μ, elongate-clavate, attenuate, clamped, pale yellowish under the microscope *en masse,* heterogeneous in content, 1- to 2- to 4-sterigmate; sterigmata 5–8 μ long, stout and somewhat constricted at the base, straight and slightly divergent.

Spores 7.1–9.3 × 3.5–5.0 μ, ovate to ellipsoid to broadly subcylindrical, smooth, thin- to very slightly thick-walled, coarsely granular (or minutely vacuolate) to multiguttulate, with a small but distinct, lateral apiculus.

Observations: This is certainly synonymous with *C. luteoalba* Rea, the name used by Corner, as reported by Petersen (**1966c**). It belongs to a complex within the genus *Clavulinopsis* which includes *C. miniata* and *C. appalachiensis,* the latter perhaps close to *Clavaria* s.s. Peck's reported colors are not typical of the species, and may have been taken from dried material. The normal population in the eastern United States is usually apricot to apricot-orange in color.

CLAVARIA GRANDIS Peck. 1902. Bull. Torrey Bot. Club **29**: 73.
≡ *Ramaria grandis* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 595–596.

Basidiocarp: Single fruiting body 15 × 5 cm, not pressed, on soil. Stem portion 1 cm thick upward, longish, about 3 cm tapering below ground level; smooth, channelled when dry. Primary branches several, 5–7 mm thick, generally ascending, smooth to somewhat longitudinally rugulose. Branching in about 5–7 ranks, rather open with longish internodes, and with lunate axils. Branch tips slender, narrowly-rounded, abruptly whitish. Color of upper branches about XV(A)11,12 (darker than "mummy brown"), lower branches and stem portion darker. Fresh color: branches reddish brown when young, ferruginous brown in age; tips white when young, concolorous in age.

Hyphal structures: Stipe—Contextual hyphae and outer hymenium completely obscured, very cohesive through agglutination or external wetting. Branches—Contextual hyphae partly obscured through cohesion, slightly thick- to thin-walled, clamped. Basidia coherent in a layer, clavate, 2-sterigmate.

Spores 11.9–16.1 × 7.0–9.1 μ, ovate to tear-drop shaped, thick-walled, yellow to ochre in bright field, usually multiguttulate, with an indistinct, lateral, thin-walled apiculus. Wall ornamented with large (up to 3.5 μ long) sharp cyanophilic warts and narrow plates so numerous as to obscure the outline of the spore body.

Observations: This is one of the most distinct species in North America. Its large size, dark brown branches with abruptly white tips, and large spores covered with enormous spines and plates are all unique. (My experience with several other collections of the species, both fresh and dried, indicates that the contextual hyphae are thin-walled, and that the basidia are basally clamped). I feel that the type specimen has been either poorly dried or "poisoned," producing a hyperagglutinated effect.

CLAVARIA HERVEYI Peck. 1893. N. Y. St. Mus. Rep. **45**: 84.

Basidiocarp: Fruiting bodies on ground, 10–30 × 3–5 mm, not pressed. Stipe slender, 1–2 mm thick, expanding somewhat upward, slightly flattened. Branches few, thick, short, subpalmate, slightly flattened; axils acute, longitudinally furrowed; apices abruptly pointed, darkish, subcristate. Color of hymenial area dull dark orange, stipe dull ochre. Fresh color: golden yellow, sometimes brownish at the apex.

Hyphal structures: Contextual hyphae 8–13 μ diam, loosely packed, thin-walled, slightly inflated, interweaving, hyaline, clamped. Subhymenial hyphae 3–6 μ diam, subtortuous, clamped, hyaline, producing basidia as side branches at first, then in cymose bouquets. Basidia 40–50 × 3.0–7.5 μ, cylindrical, with homogeneous contents, thin-walled, clamped, hyaline, invariably with post-partal septation $\frac{1}{3}$ to $\frac{1}{2}$ way from the base, 2-sterigmate; sterigmata cornute. Hymenium thickening by hyphal branching from subbasidial clamp.

Spores 8.1–9.5 × (6.7–)7.1–8.6 μ, subglobose, thin- to slightly thick-walled, smooth, uniguttulate, hyaline, with a small but distinct lateral apiculus.

Observations: Corner (**1950**) placed this in synonymy with *Clavulina rugosa* which becomes yellowish when dried. Peck's description states the fresh color to be golden yellow, and the spores are considerably smaller than those of *C. rugosa.* Petersen (**1967**) recognized the species in a taxonomic series including *Clavulina pilosa, C. floridana* and others.

CLAVARIA LAVENDULA Peck. 1910. N. Y. St. Mus. Bull. **139**: 47.

Basidiocarp: Fruiting bodies up to 3.2 × 2.5 cm, fasciculate, growing on soil, approximately 25 branches in the cluster, each branched dichotomously or subdichotomously 1–3 times, flattened and ridged but not completely collapsed. Branch apices terminating in a di- or trichotomy. Branch bases whitish, fused and covered with a very fine tomentum; color "burnt umber" above, fading to "warm buff" or "cinnamon buff" at the upper $\frac{1}{2}$ or $\frac{1}{3}$ of the fruiting body, tips slightly darker. Fresh color: lilac pink when moist, pruinose when dry.

Hyphal structures: Contextual hyphae 7–10 μ diam, mostly parallel, somewhat inflated, with primary septa constricted; secondary septa present and readily seen; walls thin above to slightly thickened below; some barrel-shaped cells present, 25–50 μ long and up to 22 μ wide without secondary septa. Long-celled, interweaving hyphae absent. Subhymenial hyphae 2–5 μ diam, frequently branching and interweaving, not agglutinated, thin-walled. Hymenium 35–67 μ thick; basidia 30–45 × 7 μ, sub-cylindric to clavate, apparently transient and collapsing soon after spore discharge; 4-sterigmate; sterigmata 2–3 μ long, straight or slightly divergent. Hyphae and basidia simple-septate.

Spores 5.7–6.8 × 2.9–4.0 μ, thin-walled, hyaline, finely granular and refractile under phase contrast, plump-cylindric to ovoid or fusoid when viewed adaxially, adaxial surface flattened and abaxial surface keeled, apiculus small.

Observations: Peck maintained that *C. lavendula* was different from *C. amethystina* Bull. (= *C. amethystina* Fr.). Donk (**1933**) transferred *C. amethystina* Fr. to *Clavulina* and separated it clearly from *C. zollingeri* Lev. which is a *Clavaria* s.s. *C. lavendula* Pk. is definitely a *Clavaria* s.s. and is probably synonymous with *C. zollingeri* as indicated by Donk (**1933**). This species is easily distinguished from other species of *Clavaria* by the highly branched fruiting body and the pink-lilac or deep purple color.

CLAVARIA LONGICAULIS Peck. 1898. Bull. Torrey Bot. Club **25**: 371–372.

≡ *Ramaria longicaulis* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 600–601.

Basidiocarp: Single fragment and small fruiting body remain; the fragment probably of the upper branches and primary branch, not stem portion and branches. Smaller branches about 2 mm diam near the tips, which are truncate. Major portion longitudinally ridged and channelled. Color uniformly umber to olivaceous umber. Fresh color: entirely dark brown.

Hyphal structures: Major branches—Contextual hyphae 4–8 μ diam, subhyaline, thin- to very slightly thick-walled, clamped, tightly packed, perhaps semi-agglutinated, parallel. Subhymenial hyphae narrow, compressed into a pseudoparenchymatous layer, pigmented pale yellow under bright field, apparently agglutinated to some extent, clamped. Basidia 38–45 μ long (hymenial measurement), coherent in a layer and therefore obscure, clamped, hyaline, projecting 5–8 μ above the hymenial surface when mature, 4-sterigmate; sterigmata stout, straight, conical.

Spores 6.6–10.0 × 4.2–6.0 μ, tear-drop shaped to curved-attenuate or broadly allantoid, thick-walled, ochraceous under bright field, with an indistinct, slightly attenuate, lateral apiculus. Wall ornamented with rounded-acute cyanophilous spines up to 3.5 μ long, often coherent into irregular plates whose widths diminish toward the proximal end of the spore.

Observations: This seems closely related to *C. murrillii* and *C. grandis* which also bear echinulate spores and coherent cortical tissue, and so belongs to a subgroup of *Ramaria*. Corner has used two groups, Echinospora and Verrucispora, to include these species.

CLAVARIA MACOUNI Peck. 1894. N. Y. St. Mus. Rep. **47**: 150.
≡ *Clavulinopsis macounii* (Pk.) Corner. 1950. Ann. Bot. Mem. 1: 378.

Basidiocarp: Fruiting bodies up to 1 cm high, 2–3 mm thick in the hymenial area, several, simple clubs, on polytrichaceous moss. Stem portion smooth, dull brown, 1 mm or less thick, up to 1 cm long. Hymenial portion dull yellow to dull orange or tan, obviously in age.

Hyphal structures: Contextual hyphae 4.0–11 μ diam, somewhat inflated, thin-walled, simple-septate, strictly parallel, hyaline, cells variable in length, without interweaving narrow hyphae. Basidia 34–47 × 5.2–6.8 μ, clavate, simple-septate, usually generally homogeneous in content, but often with granular material toward the base (1, 2-)4-sterigmate; sterigmata slender, straight, sometimes slightly divergent. Hymenial sterile elements abundant, basidioles or pseudoparaphyses, undoubtedly immature basidia. Pigmentation resident in subhymenium. Fresh color: dingy greenish yellow or pale cinereous.

Spores 4.5–6.0 × 3.0–3.8 μ, ellipsoid to pip-shaped, smooth, thin-walled, aguttulate, with homogeneous contents, with small but pronounced, slightly lateral apiculus.

Observations: This species is authoritively known from only the type collection, although there is another specimen of what appears to be the same species in the Doty herbarium in NY. It seems closely allied to *C. inaequalis* as understood by Petersen (**1965a**), with clampless basidia, yellowish coloration, and smooth, ellipsoid spores.

CLAVARIA MUSCOIDES VAR. OBTUSA Peck. 1894. N. Y. St. Mus. Rep. **47**: 151.

Basidiocarp: Fruiting bodies several, 1–3.3 × 0.4–1.5 cm, on humus, pressed. Stipe 0.6–1 cm long, 1–4 mm thick, slightly expanded upward, distinct, whitish and minutely felty below, smooth above. Major branches few, 1–2 mm thick, rebranching dichotomously, with lunate axils often somewhat narrower above. Ultimate branching usually double-dichotomous; apices minute, blunt-rounded to slightly dilated. Color pale cream at the base, major portion about XIII (C, D)8 ("Mikado brown" to "sayal brown"). Fresh color: none stated.

Hyphal structures: Contextual hyphae all thin-walled, clamped throughout, relatively straight, of 2 different widths; wider 4.5–5.5 μ diam, narrower 1–2.5 μ diam. Subhymenial hyphae 1.5–2.5 μ diam, subtortuous, thin-walled, clamped, tightly packed, producing basidia in bouquets. Basidia 27–35 μ long, clavate, clamped, homogeneous in content when young becoming multiguttulate in maturity, 4-sterigmate; sterigmata up to 9 μ long, stout, persisting, straight, sometimes slightly divergent.

Spores 4.6–5.6 × 4.2–5.6 μ, subglobose to globose, smooth, thin-walled, uniguttulate to aguttulate (in age?), hyaline, with a pronounced, conical lateral apiculus up to 2 μ long.

Observations: Peck states that this is typical of *C. muscoides* (= *Clavulinopsis corniculata*) except for the obtuse branch tips. I think it represents a young specimen of that species, the spores of which are somewhat small. Petersen (**1966c**) gave a wide range for spore size in this species, and stated that small-spored forms exist. If *C. subtilis* typically bears smaller spores than *C. corniculata* (a point which can be debated), then *C. muscoides* var. *obtusa* might be more closely related to *C. subtilis,* the fruiting bodies of which are white, but Peck specifically states similarity between his variety and *C. muscoides* which is yellow-ochre.

CLAVARIA MYCELIOSA Peck. 1904. Bull. Torrey Bot. Club **31**: 182.
≡*Ramaria myceliosa* (Pk.) Corner. 1950. Ann. Bot. Mem. 1: 607–608.

Basidiocarp: Fruiting bodies on redwood duff, up to 12 mm high. Stipe up to 9 mm long, 0.4–0.7 mm thick, slightly expanded and then flattened toward the point of branching; disappearing into a small mass of whitish rhizomorophic strands below. Branching more or less palmate; branches flattened, sparse; axils acute; apices acute, small, subcristate. Color of major portion of fruiting body about XIII(I, J)B ("buckthorn brown" to "Dresden brown"), the apices slightly lighter. Fresh color: stem and branches tawny; tips whitish.

Hyphal structures: Contextual hyphae 2.8–3.6 μ diam, thin-walled, uninflated, conspicuously clamped, occasionally swollen in a clavate fashion around septa, very pale yellow under bright field. Basidia 24–35 μ long, yellow under bright field, clavate, clamped, 2- to 4-sterigmate; sterigmata medium length, slightly incurved, stout at the base.

Spores 3.5–5.7 × 2.8–3.6 μ, subglobose to ovate, slightly thick-walled, uni- to several-guttulate, with a small, truncate, lateral apiculus.

Wall ornamented with gross cyanophilous spines; wall non-cyanophilous, non-amyloid.

CLAVARIA NEBULOSA Peck. 1898. Bull. Torrey Bot. Club **25**: 326.

Basidiocarp: Fruiting bodies fasciculate, now fragmented beyond recognition. Clubs 2–4 mm wide, terete or elongate-clavate, collapsed, apices rounded or tapered and shortly attenuate; "clove brown" below, "buffy brown" or "olive brown" above with the apices slightly darker. Fresh color: isabelline or clay color, sometimes clouded with darker hues.

Hyphal structures: Contextual hyphae mostly about 10–25 μ diam, parallel, agglutinated, slightly thick-walled, simple-septate, inflated with primary septa constricted, secondary septa present but not obvious. Subhymenial hyphae 3–5 μ diam, thin-walled, frequently branching and interweaving, simple-septate. Hymenium 40–60 μ thick; basidia 35–50 × 7.5 μ, rather persistent, not readily collapsing; clavate, contents granular and refractile under phase contrast, simple-septate, 4-sterigmate; sterigmata straight or slightly divergent. Cystidia up to 125 × 11 μ, arising from subhymenium, rather saccate, walls slightly thickened, apices tapering and bluntly rounded.

Spores 7.4–10.2 × 3.1–4.4 μ, hyaline, cylindric, smooth, straight or slightly adaxially concave, walls thin and smooth, apiculus stout.

Observations: Coker (1923) placed this species in synonymy with *C. purpurea* Fr. which seems to be a tenable hypothesis because the latter is the only species of *Clavaria* which has cystidia and spores this size.

CLAVARIA OBTUSISSIMA Peck. 1913. N. Y. St. Mus. Bull. **167**: 39.
≡ *Ramaria obtusissima* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 609–610.

Basidiocarp: Single fruiting body 10 × 7 cm, on soil. Stipe about 1 cm thick at base to 2 cm thick at apex, distinct and single, devoid of abortive branches, smooth. Primary branches 1–1.5 cm thick at base, few, generally ascending, smooth to slightly longitudinally rugulose. Internodes irregular, 0.5–1 cm long; branching pattern di- to trichotomous with broadly acute to rounded axils. Branch apices expanded, pistillariform to subumbilicate, distinctly longitudinally rugulose near the apices. Color of major portion of fruiting body about XII(G, H)6 (darker than "honey yellow"), branch tips about VI(J, K)11 ("brick red"). Stem with occasional "bloom" about VI(J, K)11 ("brick red"). Fresh color: stem whitish; apices ochraceous.

Hyphal structures: Contextual hyphae 3.5–13 μ diam, parallel, somewhat tightly packed, thin- to somewhat thick-walled, hyaline, clamped, occasionally slightly inflated, but intergrading in widths. Subhymenial hyphae 3–6 μ diam, thin-walled, clamped, hyaline, subtortuous. Basidia 50–70 μ long, clavate, attenuate, clamped, 4-sterigmate, easily collapsing. Hymenium thickening, including many effete and immature basidia.

Spores 13.3–15.4 × 3.8–4.2 μ, elongate-ellipsoid, slightly thick-walled, with 2–3 darkish smudges under phase contrast, smooth, with a stout, short, truncate, lateral apiculus; weakly and obscurely cyanophilous. The spore deposit covering the upper branches contains numerous immature, short individuals, 10.6–13.3 × 3.2–4.3 μ.

Observations: The separation between this and *C. albida* is discussed under that species. Numerous colors have been attributed to the species, but these may represent other taxa in the same complex. The pistillariform branch apices and smooth spores should serve to completely distinguish *C. obtusissima.*

CLAVARIA OBTUSISSIMA VAR. MINOR Pk. 1913. N. Y. St. Mus. Bull. 167: 34.

Basidiocarp: Single fruiting body, longitudinally sectioned and pressed; largest dimensions 8 × 8 cm. Stipe 7–13 mm thick, about 4 cm long, curving slightly and tapering slightly toward the base which is broken off; consistency very hard when dry, not easily pierced; smooth, longitudinally shallowly ridged and channelled through drying. Primary branches several, branching in about 7–9 ranks, somewhat open; with greatly shortening internodes, giving the fruiting body a dendroid appearance. Branch axils open-acute to widely rounded; apices expanded, dilated, subpetaloid to minutely pistillariform, lobed. Color of stem base about XII(I, J)9 (about "sayal brown") but with evidence of rufescence where handled, now about VII(L)7–12 (about "claret brown"). The major portion of the fruiting body, including the branch apices, about XII(I, J)9 with overtones of about XII(I, J)8 (about tawny").

Hyphal structures: Stipe—hyphae rather tightly packed, subparallel, clamped; of 3 types: a) thin-walled, uninflated, hyaline, b) thick-walled, hyaline, and c) refractile, oleaginous, tortuous, gnarled. The last are rare, but are consistent throughout the stem base tissue, are filled with some oily substance, but are thin-walled, and appear not unlike "puff" chromosomes. From the thin-walled contextual hyphae there are numerous bulbous hyphal tips which are thick-walled and delicately punctate. Branches—Contextual hyphae 3.2–10.5 μ diam, thin-walled, often slightly inflated, clamped, somewhat loosely packed, interweaving. Basidia 50–70 μ long, clavate to elongate-clavate, with a basal clamp connection, generally homogeneous in content, 4-sterigmate; sterigmata slender (stoutish when young), straight, easily collapsed, hardly divergent. The hymenium thickens to some extent.

Spores 9.1–11.2 × 3.2–4.2 μ, ellipsoid to elongate-ovoid, slightly thick-walled, with numerous small brownish vacuolar inclusions under phase contrast; with an indistinct oblique apiculus. Spore wall ornamentation under cotton blue of low, indistinct, cyanophilous papillae.

Observations: The presence of 3 distinct hyphal types in the context of the stem base, especially of the rare oleaginous, tortuous hyphae, and the dimensions and ornamentation of the spore wall all point to synonymy with *Ramaria botrytoides* (*Clavaria botrytoides,* and *C. conjuncta,* see above). It would appear that Peck placed the specimen under *C. obtusissima* because of its similarity in color and the expanded branch apices. The stipe of the specimen shows strong evidence of rufescence, especially in the area in which it would have been handled or held, a character which Peck either did not observe, or chose to disregard, or which is artifactual.

The type specimens of *C. botrytoides* and *C. conjuncta* bear occasional clamp connections on the septa of the contextual hyphae, but the basidia are regularly clamped. The above specimen bears clamp connections on virtually all the septa of the contextual hyphae, as well as the basidia.

CLAVARIA ORNATIPES Peck. 1908. N. Y. St. Mus. Bull. **122**: 18.
≡ *Clavaria trichopus* Peck. 1872. N. Y. St. Mus. Rep. **24**: 82.
≡ *Clavulina ornatipes* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 333–335.

Basidiocarp: Fruiting bodies 3–4.5 cm high, on soil, pressed on cards. Stipe up to 3 cm long, 0.5–0.7 mm thick, distinct, slender, covered with strigose fascicles of hyphae. Branches few, flattened, channelled or grooved, with narrowly rounded to acute axils and small, acute, subcristate branch apices; branching usually subpalmate. Color of stipe dull dark tan, hymenium greyish tan. Fresh color: stem fuscous or brown; branches whitish, greyish or cinereous.

Hyphal structures: Contextual hyphae 4–9 μ diam, hyaline, thin-walled, simple-septate, interweaving, tightly packed toward the base, loose above; outer contextual hyphae 2–5 μ diam, linear, thin-walled, with very pale watery brown walls under bright field. Outer hyphal fascicles on stipe of narrow, thin-walled, brownish, simple-septate hyphae. Basidia 30–60 μ long, cylindrical to subclavate, simple-septate, mostly homogeneous in content, 2-sterigmate; sterigmata stout, cornute, 4–8 μ long. Post-partal septation invariable, ¼ to ½ way from the basidial apex; the upper portion of the basidium collapsing, the lower portion remaining turgid.

Spores 7.9–13.4 × 7.5–10.2 μ, globose, subglobose to broadly pip-shaped, smooth, thick-walled, uniguttulate (aguttulate through age), hyaline.

Observations: Petersen (**1964**) has reported in detail on this species and described a variety with clamp connections from western North America. The species belongs to a small complex within *Clavulina* which Corner (**1950**) termed *Fusco-clavulina,* and which includes *C. decipiens,* and *C. mutabilis* Pet. (**1967**). The above species is probably the most reduced member of that line, which is characterized by the brownish pigmentation of the walls of the cortical hyphae.

CLAVARIA PALLESCENS Peck. 1909. N. Y. St. Mus. Bull. **131**: 34–35.

Basidiocarp: Fruiting bodies fasciculate in clusters of 3–10, 4 cm high. Clubs clavate, longitudinally furrowed, rather tough in consistency, "clay color"; apices expanded and flattened, tending toward spathulate, tapered to bluntly rounded. Bases of clubs fused and covered with a thin hyphal tomentum "warm buff" in color. Fresh color: club pale buff fading to whitish; stem pale yellow.

Hyphal structures: Contextual hyphae mostly about 10 μ diam, but with some short barrel-shaped cells up to 22 μ wide, parallel, somewhat agglutinated, simple-septate, inflated with primary septa constricted; secondarily septate; slightly thick-walled, interweaving with narrow, thin-walled hyphae, 2–3 μ diam. Subhymenial hyphae 3–7 μ diam, thin-walled, frequently branching and interweaving. Hymenium 40–75 μ thick; basidia 30–45 × 5–7 μ, not strongly agglutinated, persistent, elongate-clavate, basally bifurcate or with a wide looplike clamp; 4-sterigmate; sterigmata straight or slightly divergent with expanded bases.

Spores 8.8–10.8(–13.0) × 3.7–4.7(–6.4) μ, hyaline, thin-walled, smooth, plump cylindric to cylindric, generally adaxially flattened, 1-guttulate or having a mottled appearance under phase contrast; apiculus evident but small.

Observations: Peck said this was allied to *C. ligula* Fr. but was smaller and more pallid-yellow and had broader spores than the latter. These criteria, in addition to the caespitose habit of growth of *C. pallescens,* should serve to separate the two. Coker (**1923**) placed this species in synonymy with *C. argillacea* Fr. and appeared to be justified in doing so. The species belongs to Corner's (**1950**) subgenus *Holocoryne* and can be distinguished from *C. acuta,* apparently its closest relative, by the longer, narrower spores of *C. pallescens.*

CLAVARIA PINOPHILA Peck. 1884. N. Y. St. Mus. Rep. **35**: 136.

Basidiocarp: Fruiting bodies 1.5–4.5 cm high, on small bits of wood or lignous duff. Stipe slightly ridged or channelled, especially upward; covered with a slight "bloom" of whitish mycelium, arising from a felty tomentum (in places becoming substrigose). Major branches 1–2 mm thick, rebranching repeatedly to form a thick bush of branchlets; branching tri- to polychotomous; axils rounded to broadly rounded; apices acute to subfiliform, short, rather abruptly whitish. Tissue in KOH turns the solution brownish. Color of major portion of fruiting bodies about XII(D, E)4 (darker than "deep olive buff") to about XII(F, G)8 ("sayal brown"). Fresh color: branches pale-ochraceous; apices white.

Hyphal structures: Stipe—Contextual hyphae parallel to subparallel, rather straight, long-celled, clamped, with varying wall thickness, tightly packed in the outer tissue, generally of two types; a) 2.4–4 μ diam, often refractile under phase contrast, with slightly roughened, obscured wall, wall roughness increasing with thickness, and b) 3.5–4.9 μ diam, smooth-walled, including numerous small, obscure, dark bodies in brownian motion under phase contrast, and bulbous-clavate swellings adjacent to septa. Stipe covered with spores, but no apparent hymenium. Branches —Contextual hyphae 2.4–4 μ diam, loosely interweaving, rather straight, thick-walled. Basidia 26–32 μ long, clavate, thin-walled, refractile when young, clamped, perhaps agglutinated, 4-sterigmate.

Spores 6.7–9.1 × 3.8–4.6 μ, smooth, thin-walled, hyaline, short-cylindrical, aguttulate, with a small but distinct lateral apiculus.

Observations: This seems to represent a distinct species of *Lentaria* closely related to *L. surculus* and *L. epichnoa.* Fruiting bodies of all 3 species arise from a corticioid basal mat or pad rather than ramifying rhizomorphic strands as found in *L. bysisseda* and *L. patouillardii.* Petersen (**1966b**) has made distinctions between *Lentaria* Corner and *Multiclavula* Pet., the latter including several lichenoid species from Corner's subgenus *Lentariopsis.*

CLAVARIA PISTILLARIS UMBONATA Pk. 1900. N. Y. St. Mus. Mem. IV. 3: 178.

Basidiocarp: Two fruiting bodies 7.5–9.0 × 1.9–2.3 cm, simple clubs with no branching, probably on deciduous leaf litter and soil. Stem base extending below substratum level up to 1.3 cm, narrowly rounded and slightly tapering below, barely strigose-felty in patches below, but glabrous for the most part. Club clavate, longitudinally rugose or longitudinally channelled or ridged, with transverse wrinkles in the widest portion; apex subumbonate to apically hemispherically rounded. Color of stem base whitish, lower stem XIV(F, H)10,11 ("ochraceous tawny" or "snuff brown"), middle portion XIV(B, C)4,5 ("grayish olive"), and the apex VIII(L)8,9 (darker than "chestnut brown"). Fresh color: ochraceous buff, the umbo reddish brown, flesh white.

Hyphal structures: Lower stem: Outer tissue of hyphae 2.4–3.0 μ diam, slightly thick-walled to thick-walled, clamped, refractile under phase contrast because of the wall thickness. Medullary tissue of hyphae 4.5–14 μ diam, tightly packed and interweaving, slightly inflated, thin-walled, clamped. Pigmentation resident in the outer tissue, the inner tissue off-white. Upper portion: Medullary tissue as above. Subhymenium rudimentary, of hyphae 2.8–3.6 μ diam, thin-walled, clamped, hyaline, uninflated, generally interweaving and somewhat loosely arranged. Basidia 90–100 μ long, elongate-clavate, especially in youth, becoming slightly bulbous toward maturity, clamped, with numerous amorphous inclusions, 4-sterigmate; sterigmata stout, 6–8.5 μ long, straight, hardly divergent. The hymenial layer thickens to some extent, the actual depth not determined.

Spores 8.4–12.6 × 5.6–7.0 μ, smooth, hyaline, ellipsoid to broadly ovate, thin-walled to slightly thick-walled, with numerous small amorphous inclusions not vacuolar or crystalline, with a truncate-rounded, oblique apiculus.

Observations: Except for the deeper coloration of the apex of the fruiting bodies, and perhaps some tendency to become slightly unbonate, I cannot find significant differences between this and the typical form of *Clavariadelphus pistillaris*. Peck states as much, and does not dignify the form with nomenclatural status.

CLAVARIA PLATYCLADA Peck. 1896. Bull. Torrey Bot. Club **23**: 419.

Basidiocarp: Fruiting bodies 25–60 × 3–5 mm, fasciculate in clusters of 2–20 individuals, nakedly inserted in substrate; in soil; flesh solid throughout. Individual clubs not significantly attenuate below or above; apices rounded to acute. Color bright ochraceous yellow above, ochraceous orange in the middle, pale yellow below. Fresh color: base whitish; upper portion canary yellow, apices becoming brownish in age.

Hyphal structures: Contextual hyphae thin- to very slightly thick-walled, especially toward the fruiting body base, slightly inflated, clamped, of 2 different widths: 10–12 μ diam, and 2–3.5 μ diam, the wider rather straight, subparallel, interwoven with the narrower. Subhymenial hyphae 1.5–2.5 μ diam, pale yellowish under bright field, tortuous, tightly packed, producing basidia in clusters or bouquets. Basidia 35–70 μ long, elongate-clavate to clavate, clamped, weakly pigmented, 4-sterigmate; sterigmata 5–7.5 μ long, stout, slightly divergent and slightly incurved.

Spores 4.8–7.2 × 4.8–6.9 μ, globose to subglobose, slightly thick-walled, smooth, hyaline, uniguttulate, with a pronounced lateral apiculus.

Observations: This is indistinguishable from *Clavulinopsis fusiformis* when the range of variability of that species is known, and has been placed in synonymy with it by most major authors (see Corner, **1950**; Petersen, **1966c**). It is closely related to *C. laeticolor* on one hand and to *C. corniculata* on another.

CLAVARIA PULCHRA Peck. 1876. N. Y. St. Mus. Rep. **28**: 53.
≡ *Clavulinopsis pulchra* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 384–385.

Basidiocarp: Fruiting bodies up to 3 cm high, 2–2.5 mm thick below to 3–4 mm thick at the widest point, simple, clavate, with acute to narrowly rounded-acute apices, solitary to subfasciculate in 2's or 3's, on soil; arising from a small basal mycelial pad or mat. Color dull dark ochraceous orange above, lighter below and light ochraceous or whitish at the base. Fresh color: club yellow, sometimes slightly darker above; stem pale yellow to whitish below.

Hyphal structures: Contextual hyphae thin-walled, clamped, of two different widths: 1) up to 12 μ thick, slightly inflated, almost strictly parallel, and 2) uninflated, 2–5 μ diam, interweaving. Subhymenial hyphae tortuous, highly pigmented, frequently branched, producing basidia in bouquets. Basidia 35–60 × 4–7 μ, elongate-clavate, clamped, yellowish, multiguttulate when mature, 4-sterigmate; sterigmata 6–9 μ long, stout and slightly incurved.

Spores 4.8–7.4 × 3.7–5.7 μ, smooth, broadly ovoid to broadly ellipsoid to generally broadly subtriangular, hyaline, slightly thick-walled, with a very prominent, stout, conical lateral apiculus.

Observations: This has been shown by Petersen (**1965b**) to be synonymous with *Clavulinopsis laeticolor.* It is closely related to *C. fusiformis* on the one hand, and *C. gracillima* (see above) on the other.

CLAVARIA PUSILLA Peck. 1873. Bull. Buffalo Soc. Nat. Sci. **1**: 62.
≡ *Ramaria pusilla* (Pk.) Corner. 1950. Ann. Bot. Mem. **1**: 617.

Basidiocarp: Fruiting bodies up to 3 cm high, on wood or lignous duff, arising from a creamy yellow felty mass which disappears into a mass of rhizomorphic strands 3–4 mm long. Stipe 1–2 mm thick, 0.5–1 cm long, distinct, dull olive ochre. Primary branching polychotomous, from a slightly expanded stem apex, rebranching into many small, finely divided branchlets in 4–5 ranks; apices finely denticulate and concolorous with the branches. Branches dull olive brown or dull brown. Fresh color: yellowish.

Hyphal structures: Contextual hyphae 2.5–5 μ diam, uninflated, slightly thick-walled, especially near the clamp connections; long-celled, interwoven, tightly packed, hyaline (although pale brownish under the dissecting microscope). Subhymenial hyphae 1.5–3 μ diam, thin-walled, tortuous, somewhat inflated adjacent to the clamps. Basidia evidently quite small and easily collapsed, not observed.

Spores 4.2–5.0 × 2.8–3.5 μ, ovoid to broadly tear-drop shaped, slightly thick-walled, ochre to yellow ochre under bright field, with an indistinct, extruding lateral apiculus. The wall is ornamented with scattered, sharp, cyanophilous spines slightly less than 1 μ long.

Observations: There is another portion of the type specimen at NY which matches exactly. The internal anatomy is of *Lentaria,* with the thick-walled, interweaving, loosely arranged contextual hyphae, but the spores come very close to the Verrucispora group of *Ramaria.* It is distinct, but its proper placement is problematic.

CLAVARIA SIMILIS Peck. 1890. N. Y. St. Mus. Rep. **43**: 70.
≡ *Clavaria peckii* Sacc. 1891. Syll. Fung. **9**: 249.

Basidiocarp: Fruiting bodies up to 3.5 cm high, slender, solitary or connate at the base, all branched to some extent; on soil. Stipes 5–20 × 0.7–1.5 mm, distinct, expanded slightly upward, usually more or less connate toward the base, often strigose-felty below, arising from a strigose-felty mat. Branches 1 mm or less in thickness, rebranching dichotomously; axils acute (and then decurrent by a line) to open or lunate; apices rounded to narrowly rounded, not tapering, about the same width as the branches. Color about dull buffy yellowish, the stem portion slightly darker, in the dull buffy orange range. Fresh color: pallid.

Hyphal structures: Contextual hyphae tightly packed, generally parallel, of different widths, wider 5–9 μ diam, thin-walled, clamped, straight; narrower 1.5–3 μ diam, thin-walled, clamped, subtortuous. Subhymenial hyphae 1.5–2.3 μ diam, thin-walled, tortuous, clamped, slightly pigmented, producing basidia in "bouquets" in a thickening hymenium. Basidia 46–75 × 5.7–7.0 μ, elongate-clavate, clamped, slightly refractile when young under phase contrast, 4-sterigmate; sterigmata stout, up to 9.5 μ long, slightly incurved, slightly divergent.

Spores 5.9–7.1 × 5.6–6.5 μ, subglobose, smooth, refractile under phase contrast, aguttulate (in age?), with a prominent conical apiculus.

Observations: This is conspecific with *Clavulinopsis corniculata* as the latter is recognized by most authors. There are differences between the typical form of *C. corniculata* and what has been called *Clavaria fastigiata,* the former producing solitary, branched fruiting bodies, the latter producing fruiting bodies subfascicled or somewhat basally connate. This specimen fits the latter description, but I do not ascribe species rank to the various forms, many of them reflecting microecological variations.

CLAVARIA SPATHULATA Peck. 1875. N. Y. St. Mus. Rep. 27: 100.
≡ *Pistillaria spathulata* Corner. 1950. Ann. Bot. Mem. 1: 492.

Basidiocarp: Fruiting bodies up to 2 mm high, up to 0.5 mm thick at base, up to 1 mm thick in the hymenial area, caespitose in clusters of 2–3, emergent through lenticles and crevices in bark of woody twig, perhaps cherry. Stem portion smooth, almost glabrous, off-white or pale cream in color, dotted with amorphous crystals. Hymenial area smooth, not glabrous, pale yellowish in color. Club apices broadly rounded to rounded-truncate, but not truly spathulate. Fresh color: pale yellow.

Hyphal structures: Stem portion—Contextual hyphae 2.1–4 μ diam, thin-walled, sub-agglutinated, simple-septate (rarely with very small, obscure clamp connections), hyaline; no caulocystidia. Club portion—Contextual hyphae 2.1–7 μ thick, loosely interweaving, non-agglutinated, occasionally slightly inflated, thin-walled, simple-septate, with very complex branching and anastomosis patterns. Subhymenial hyphae uninflated, simple-septate, tightly packed, tortuous, producing basidia in monopodial bouquets. Basidia 28–37 μ long, cylindrical to subcylindrical, simple-septate, hyaline, apparently collapsing quite quickly after spore discharge, 4-sterigmate; sterigmata very stout when young, becoming straight, stout, non-divergent, and up to 7 μ long. Many slightly thick-walled basidium-like hyphal tips are included in the hymenium. These evacuate at maturity and form a median, curved septum about midway up the hyphal tip, making the resulting structure remarkably like the partially evacuated basidia of *Clavulina.* Additional sterile hymenial elements 36–45 μ long, with vescicular tips, much as though some cytoplasm had been forced out of the hyphal tip.

Spores 7.0–9.8 × 3.8–5.6 μ, ovate to short cylindrical, smooth, very thin-walled, aguttulate, completely homogeneous in content, with a small distinct lateral apiculus which has a very small black structure at the distal end under phase contrast.

Observations: Corner has placed this under *Pistillaria,* which is the obvious choice. The semi-agglutinated hyphae of the lower portion and the small basidia and very thin-walled spores would indicate this group.

CLAVARIA STRICTA VAR. FUMIDA Peck. 1888. N. Y. St. Mus. Rep. 41: 86.

Basidiocarp: Fruiting bodies 7.5–8.5 × 3.5 cm, on wood, pressed. Stipe subfasciculate of several substipes 3–6 mm thick, smooth, rounded at the base, expanded slightly upward to the point of branching, arising from a cottony or felty mycelial mass in the substrate. Branches in 6–9 ranks, with long internodes and strictly ascending branchlets, slender and slightly expanded upwards, with axils narrowly rounded and sometimes decurrent by a line; primary branching polychotomous, subsequent branching strictly dichotomous. Apices tuning-fork-like, with each tip divided in a bifurcate fashion in the last 1 mm or less; narrowly acute. Color of major portion of fruiting body about XI(C, D)5 ("pinkish buff"), with the tips darker, about V(C, D)10 ("testaceous" to "cacao brown"). Fresh color: entirely dingy, smoky-brownish hue.

Hyphal structures: Stipe—Contextual hyphae of two types: a) 1.9–2.3 μ diam, slightly thick-walled, clamped, rather straight but interweaving, often anastomosing in "H"-Connections, and b) 5.5–8 μ diam, clamped, walls so thick that the cell lumen is obscured; refractile under phase contrast, rather straight and stiff but seldom branching or anastomosing. Branches—Contextual hyphae 3.5–10 μ diam, mostly thick-walled, non-refractile, slightly inflated, straight, subparallel, clamped, hyaline. Subhymenial hyphae 2.1–2.5 μ diam, thin-walled, tortuous, loosely interwoven. Basidia 30–50 × 5–7 μ, clavate, clamped, thin-walled, apparently hyaline, 4-sterigmate; sterigmata up to 7.5 μ long, slender, straight, not divergent.

Spores 7.7–9.1 × 3.5–4.6 μ, ovate to amygdaliform, thick-walled, yellow to ochre under bright field, with numerous darkish vacuoles under phase contrast; apiculus somewhat indistinct, prominent, lateral. Spore wall ornamented with extremely low, cyanophilous ridges or warts when mature, but virtually smooth when young. Spore wall non-cyanophilous and non-amyloid.

Observations: I cannot find any sufficient reason to separate this from the typical *Ramaria stricta* found in North America. Peck stated that the branches were darker and duller in color than the typical variety, but this variation in color can hardly be a varietal difference in this species on this continent. The very thick-walled skeletal hyphae of the context may indicate a closer relationship with the *R. gracilis* group than has been previously postulated.

CLAVARIA SUBCAESPITOSA Peck. 1913. N. Y. St. Mus. Bull. **167**: 39.

Basidiocarp: Fruiting bodies 6.5–8 × 5.5–6.5 cm, on rich humus, pressed. Stipe about 1 cm long, slender, rounded below, usually branched from near the base which is about 2.5 cm below substrate level, covered with smooth, minutely felty mycelial mat up to the branching point. Branches 2–6 mm thick, in about 5–7 ranks, generally ascending but curled and twisted, smooth, flattened somewhat above; internodes 5–10 mm long; axils generally rounded to lunate; apices filiform, narrowly rounded to acute, up to 10 mm long, occasionally shorter, and then usually bidentate. Color about X(F, G)5 ("light ochraceous buff") throughout, with the branches and branch apices slightly darker, about XII(C, D)9 ("tawny"). Fresh color: uniformly white or whitish.

Hyphal structures: Contextual hyphae 3.5–7 μ diam, strictly parallel with very little interweaving; thin-walled to (occasionally) slightly thick-walled, semi-agglutinated, especially below, clamped, hyaline. Subhymenial hyphae 2.1–3 μ diam, thin-walled, tortuous, tightly interwoven but not agglutinated. Basidia 20–30 μ long, apparently agglutinated in a solid layer, clamped, 4-sterigmate; sterigmata slender, straight. Hymenium with no evidence of thickening.

Spores 4.9–6.3 × 4.2–4.8 μ, ovate to broadly ellipsoid, thin-walled, hyaline, with a short, almost papillate lateral apiculus. Wall ornamented with short, numerous spines so that it is roughly verruculose.

Observations: This is very close to *Ramariopsis kunzei.* It forms part of a reduction series including the latter, *R. asterella* and *R. vestitipes,* in which the fruiting body and spore size diminishes and pigmentation increases. Semi-agglutinated contextual tissue is also consistent within this complex of *Ramariopsis.*

CLAVARIA TSUGINA Peck. 1903. N. Y. St. Mus. Bull. **67**: 27–28.

Basidiocarp: Fruiting bodies 4.5–6.5 × 2.5–4 cm, on well rotted wood, pressed. Stipe 6–7 mm thick, distinct, slightly flattened, glabrous to smooth, slightly overlaid with a minutely felty mycelium in the lower portions. Primary branching sparse, polychotomous, subsequently dichotomous, rebranching in 5–8 ranks. Branches smooth, slightly flattened; axils narrowly rounded, often with thin mycelial tissue between the branches in a webbed arrangement; apices filiform to acute, 2–3 mm long, bidentate. Color of major portion of stem and branches about XII(I, L)4 ("ecru olive" to "old gold"), to XIII(I, L)4 ("light yellowish olive"). Other areas of the stem and branches are about XI(I, J)4,5 ("honey yellow"), with glabrous areas of the stem about VII(H, I)10,11 ("chocolate"). Fresh color: young plants and growing tips creamy yellow; older parts and mature plants vinaceous cinnamon or reddish brown.

Hyphal structures: Stipe—Hyphae of outer tissue 3.5–6 μ diam, tangled, tightly interwoven, somewhat agglutinated, thin- to (mostly) thick-walled, uninflated, clamped, frequently branching and anastomosing. Medullary hyphae identical, more loosely arranged. Branches—Contextual hyphae 3–4.5 μ diam, with rare refractile hyphae present under phase contrast; loosely interweaving, tightly packed just below hymenium, clamped, hyaline or subhyaline, slightly thick-walled. Basidia 34–45 × 8–11 μ, clavate, thin-walled, truncate and often protruding when young, clamped, homogeneous in content, slightly yellow in mass, 4-sterigmate; sterigmata up to 7 μ long, slender, slightly incurved. Hymenium apparently slightly agglutinated.

Spores 7.0–9.3 × 3.5–4.2 μ, ellipsoid, very slightly thick-walled, very pale yellow under bright field, aguttulate, almost completely homogeneous in content, with an indistinct thin-walled lateral apiculus. Wall smooth when young, ornamented in age with minute, very short cyanophilous spines to give it a subverruculose to asperulate texture.

Observations: Peck stated that the stipe did not turn greenish where bruised, separating it from *C. abietina* (= *Ramaria ochraceo-virens*). However, he failed to mention the obvious green coloration of the stem. The anatomic characteristics of the fruiting body are all typical of the Verrucispora group of *Ramaria.* Corner and Coker place the species in synonymy with *R. apiculata,* but I have not seen type material of that species.

CLAVARIA TYPHULOIDES Peck. 1878. N. Y. St. Mus. Rep. **30**: 49.
≡*Pistillaria typhuloides* (Pk.) Burt. 1922. Ann. Missouri Bot Gard. **9**: 69.

Basidiocarp: Fruiting bodies up to 3 mm high, about 0.3 mm thick below, about 0.7 mm thick above, broadly clavate, simple, scattered, on dead stems of *Epilobium angustifolium;* erumpent from minute cracks in the epidermis. Stem portion subtranslucent, subcartilaginous, pale cream or white, with numerous amorphous crystalline structures on the surface. Hymenial portion dilated, smooth but not glabrous, pale golden yellow. Fresh color: white.

Hyphal structures: Stem portion—Hyphae of outer tissue 2.1–3.5 μ diam, hyaline, thin-walled, straight, parallel, semi-agglutinated, with short, gnarled, abortive hyphal branches protruding randomly, the outer-oriented tips becoming cystidioid, the lateral branches interweaving between the parent hyphae. Hyphae of inner tissue 5.0–6.0(–8.5) μ diam, slightly thick-walled to thick-walled, straight, parallel, loosely arranged, agglutinated in places. Club portion—Contextual hyphae 4.2–6.5 μ diam, loosely interwoven, clamped, hyaline, very slightly agglutinated in places, very slightly inflated, with complex branching and anastomoses. Subhymenial hyphae 2.1–3.2 μ diam, tortuous, producing basidia in monopodial clusters. Basidia 28–36 μ long, narrowly clavate to subcylindrical, hyaline, clamped, 4-sterigmate; sterigmata very stout at first, then elongating into slender structures. Hymenium thickening slightly by hyphal branching from basidial clamp.

Spores 7.0–9.8 × 2.4–3.1 μ, suballantoid to curved-cylindrical, smooth, very thin-walled, granular to minutely multiguttulate in content, with an indistinct, short apiculus.

Observations: This can hardly be distinguished from *C. spathulata* (see above) except by the curved, broader shape of the spores, and presence of clamps. Corner (**1950**) has placed it in *Pistillaria,* a correct choice on the basis of agglutinated, clamped contextual hyphae.

CLAVARIA VESTITIPES Peck (see *C. bicolor,* above).

CLAVARIA XANTHOSPERMA Peck. 1905. N. Y. St. Mus. Bull. **94**: 21.
≡ *Ramaria xanthosperma* (Pk.) Corner. 1950. Ann. Bot. Mem. 1: 632.

Basidiocarp: Two fruiting bodies 3.5–4.0 × 3.0–3.5 cm, on soil, not pressed. Stipe stout, 1.0–1.4 cm thick, very slightly tapered below, not rooting; smooth, slightly wrinkled, drying to semi-punky consistency. Primary branches 2–3, each 3–4 mm thick, rebranching to about 7–8 ranks, with internodes of medium length below, shortening above; axils rounded to lunate below, broadly acute to acute above and then decurrent by a line. Upper branches minutely pruinose, generally ascending; apices minute, rounded, bi- or polychotomously cusped, with pigmentation evident only in outer cortical area. Color of stem portion about VI(B, D)10,11 ("auburn") upper stem portion and lower and mid-branches about XI(H, I)7 ("honey yellow"), apices slightly ruddy, about III(E, F)11 ("light coral red" to "coral red"). Fresh color:

entirely white, becoming yellowish or cream-colored with age; stem red where bruised.

Hyphal structures: Stipe—Contextual hyphae simple-septate, of the following types: 1) 2.0–2.5 μ diam, thin-walled, interweaving, 2) thick-walled, thicker hyphae, non-refractile under phase contrast, frequently producing clavate swellings juxtaposed to septa, and 3) 6.5–9 μ diam, refractile, thick-walled. Branches—Contextual hyphae 2.8–8.5 μ diam, almost all thin-walled, parallel, tightly packed, simple-septate, frequently branching and anastomosing, occasionally refractile. Basidia 45–55 μ long, subclavate, simple-septate, hyaline, homogeneous in content, 4-sterigmate; sterigmata slender, straight to slightly divergent, easily collapsed. Basidia and basidioles protrude from the young hymenium 5–40 μ.

Spores 11.9–17.5 × 3.2–4.2 μ, cylindrical to subsinuous or very sway-back, slightly thick-walled, with an oily brownish smudge within under phase contrast and an indistinct, conical, lateral apiculus. Wall ornamented with very low, subpruniform cyanophilous wrinkles in a subspiral configuration: wall non-cyanophilous, dark ochre in Melzer's reagent.

Observations: This is closely related to *C. conjuncta* (see above) from which it differs in its longer, narrower and less ornamented spores. Both species belong in *Ramaria* as that genus is presently understood. The intense rufescence of the stem where bruised makes the species quite distinctive in the field.

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